The opinion in support of the decision being entered today is *not* binding precedent of the Board

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte HENRY ESMOND BUTTERWORTH,
CARLOS FRANCISCO FUENTE, and
ROBERT FRANK MADDOCK

_____

Appeal 2007-1192
Application 09/401,676[1]
Technology Center 2100

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Decided: June 27, 2007

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Before HOWARD B. BLANKENSHIP, JAY P. LUCAS, and
SCOTT R. BOALICK, *Administrative Patent Judges*.
BOALICK, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from a final rejection of

claims 1-14. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

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[1] Application filed September 22, 1999. Application 09/401,676 claims the benefit under 35 U.S.C. § 119 of United Kingdom application 9906501.3, filed 03/23/1999. The real party in interest is International Business Machines Corp.

STATEMENT OF THE CASE

Appellants' invention relates to the scheduling of tasks in a data processing system to process work items such as requests to read data from and write data to a data storage system. (Specification 1:5-8; 8:13-15.) In the words of the Appellants:

> The present invention is . . . contrasted with prior systems in which, when an interrupt is serviced and a task scheduled for later execution, the interrupt is enabled/unmasked. Thus in prior systems, the receipt of further work items will cause the generation of further interrupts. In the present invention, the interrupt is not enabled when the interrupt is serviced and therefore further work items will not generate interrupts. When the task executes, it processes the work items after which a speculative task is scheduled and added to the task queue. The task is speculative in the sense that when it is generated there are no work items on the queue to be processed. However it is anticipated that further work items will have been added by the time the speculative task reaches the head of the task queue and is executed.
>
> In accordance with one embodiment of the invention, the method could include the step of continually scheduling speculative tasks (i.e. polling) for processing of work items that may subsequently be received in the system. . . .
>
> In a preferred method, when the speculatively scheduled task is executed to process any work items received by the system and it is determined that there are no work items, the interrupt is enabled. Thus when the system is fully utilised, the interrupt mechanism is replaced with a polling mechanism involving a continuous series of speculatively scheduled tasks. However when the system or device utilisation decreases, i.e. when there are no work items when the speculatively scheduled task is processed, then the system reverts to interrupts.

(Specification 3:20 to 4:27.)

Claims 1 and 12 are exemplary:

1.   A method of processing work items in a data processing system comprising the steps of:

generating an interrupt in response to receipt of a work item in the system;

disabling system interrupts;

scheduling a task through the generated interrupt for processing of the work item;

executing the task to process the work item;

processing additional work items received by the system; and

when there are no additional work items for processing, speculatively scheduling a further task for processing of subsequently received work items in the system, without enabling system interrupts.

12.   A method of processing work items in a data processing system, comprising:

effectively providing an interrupt-based mechanism for processing work items, when system utilization is low with respect to work items; and

effectively providing a polling-based mechanism for processing work items, when system utilization is relatively high with respect to work items.

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Hoffman	US 5,414,858	May 9, 1995
Scales	US 5,933,598	Aug. 3, 1999

Claims 1-11 stand rejected under 35 U.S.C. § 103(a) as being obvious over Hoffman and Appellants' Admitted Prior Art (AAPA).

Claims 12-14 stand rejected under 35 U.S.C. § 102(a) and 35 U.S.C. § 102(e) as being anticipated by Scales.

Rather than repeat the arguments of Appellants or the Examiner, we make reference to the Briefs and the Answer for their respective details. Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but chose not to make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2004).[2]

ISSUES

1. Whether Appellants have shown that the Examiner erred in rejecting claims 1-11 under 35 U.S.C. § 103(a). The issue turns on whether

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[2] Except as will be noted in this opinion, Appellants have not presented any substantive arguments directed separately to the patentability of the dependent claims or related claims in each group. In the absence of a separate argument with respect to those claims, they stand or fall with the representative independent claim. *See In re Young,* 927 F.2d 588, 590, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991). *See also* 37 C.F.R. § 41.37(c)(1)(vii).

Hoffman and the AAPA describe or suggest each and every limitation of the claims.

2. Whether Appellants have shown that the Examiner erred in rejecting claims 12-14 under 35 U.S.C. § 102(a) and 35 U.S.C. § 102(e). The issue turns on the interpretation of claim 1 and whether Scales describes or suggests each and every limitation of the claims.

FINDINGS OF FACT

1. Hoffman describes a system and method for managing service requests from peripherals connected to a personal computer or workstation by operating in both an interrupt mode and a polling mode, with selectively transitioning between modes. (Abstract.) The servicing of the peripheral devices by the work station may be done by a central processor or an I/O processor. (Col. 1; ll. 24-26.) Peripheral devices include disk storage media. (Col. 2, ll. 61-63.) The system of Hoffman "can with equal relevance apply to a system or processor bus which has devices peripheral to the processor competing for processor servicing resources." (Col. 4, ll. 39-41.)

2. Hoffman describes the use of both polling and interrupts. (Col. 1, ll. 26-32; Col. 2, l. 66 to Col. 3, l. 8.) Polling involves successive queries to the peripheral devices regarding their needs for servicing. (Col. 1, ll. 27-30.) Interrupts involve the peripheral devices signaling a need for service to the processor. (Col. 1, ll. 30-33.)

3. Hoffman teaches that polling is considered to have a lower latency, but the processor performing the polling may expend a disproportionately large amount of time polling in relation to other functions when the service requests are at a low level of occurrence. (Col. 1, ll. 33-42; Col. 3, ll. 21-29.) Hoffman also teaches that an interrupt mode usually has greater latency than polling. (Col. 1, ll. 43-54; Col. 3, ll. 8-20.) However, when the service requests are infrequent, Hoffman teaches that interrupt mode is more processor efficient than polling. (Col. 1, ll. 54-57.)

4. The system of Hoffman transitions between an interrupt mode and a polling mode responsive to the rate of service requests. (Col. 2, ll. 6-14; Col. 3, ll. 30-33; Figures 3 & 4.) In a preferred embodiment, operation commences in the interrupt mode. (Col. 2, ll. 20-23; Col. 3, ll. 33-34.) If the rate of service requests exceeds a threshold, the mode transitions from interrupt to polling. (Col. 2, ll. 25-28; Col. 3, ll. 34-38.) The polling mode continues until the rate decreases below the threshold, reverting the system back to interrupt mode. (Col. 2, ll. 28-31; Col. 3, ll. 43-48.) Thus, the system switches between interrupt mode and polling mode depending upon the rates of service requests generated by the peripheral devices. (Col. 3, ll. 48-51.) Hoffman teaches that this technique optimizes the servicing of the peripheral devices. (Col. 2, ll. 31-34.)

5. The AAPA describes the operation and handling of interrupts in a data processing system, as well as performance trade-offs related to

interrupt and polling techniques. (Specification 1:11 to 2:28.)

6. Scales describes a distributed shared memory system that enables data sharing between workstations connected to each other by a network. (Col. 2, l. 66 to Col. 3, l. 5.)

7. Scales teaches that a polling mechanism is used to process the messages generated by the workstations. (Col. 13, ll. 45-46.) If the network is one which has short latencies, the polling can be on a more frequent basis. (Col. 13, ll. 54-56.)

8. Scales also teaches that "[m]essages could be serviced using an interrupt mechanism. However, servicing an interrupt usually takes longer to process, since the state which exists at the time of the interrupt must first be saved and subsequently be restored." (Col. 13, ll. 60-63.) Scales instructs that "[p]olling also has the advantage that the task of implementing atomic protocol actions is simplified." (Col. 13, ll. 64-65.)

PRINCIPLES OF LAW

The Board must necessarily weigh all of the evidence and argument in reviewing the Examiner's decision on appeal. *See In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984).

The Examiner bears the initial burden of showing a prima facie case of unpatentability. *In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788

(Fed. Cir. 1984). When that burden is met, the burden then shifts to the applicant to rebut. *Id.*; *see also In re Harris*, 409 F.3d 1339, 1343-44, 74 USPQ2d 1951, 1954 (Fed. Cir. 2005) (finding rebuttal evidence unpersuasive). If the applicant produces rebuttal evidence of adequate weight, the prima facie case of unpatentability is dissipated. *In re Piasecki*, 745 F.2d at 1472, 223 USPQ at 788. Thereafter, patentability is determined on the totality of the record. *Id.*

Anticipation is established when a single prior art reference discloses expressly or under the principles of inherency each and every limitation of the claimed invention. *Atlas Powder Co. v. IRECO Inc.*, 190 F.3d 1342, 1347, 51 USPQ2d 1943, 1946 (Fed. Cir. 1999); *In re Paulsen*, 30 F.3d 1475, 1478-79, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994).

Obviousness under 35 U.S.C. § 103 "depends on (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) any relevant secondary considerations, including commercial success, long felt but unsolved needs, and failure of others." *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1360, 80 USPQ2d 1641, 1645 (Fed. Cir. 2006) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966)). Although the sequence might be reordered in a particular case, the *Graham* factors define the inquiry that controls the issue of obviousness. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734, 82 USPQ2d 1385, 1391 (2007).

The mere existence of differences between the prior art and the claim does not establish nonobviousness. *Dann v. Johnston*, 425 U.S. 219, 230, 189 USPQ 257, 261 (1976). The issue is "whether the difference between

the prior art and the subject matter in question 'is a difference sufficient to render the claimed subject matter unobvious to one skilled in the applicable art.'" *Id.* at 228, 189 USPQ at 261 (citation omitted). To be nonobvious, an improvement must be "more than the predictable use of prior art elements according to their established functions." *KSR*, 127 S. Ct. at 1740, 82 USPQ2d at 1396.

The Supreme Court has recently reaffirmed the principle that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR*, 127 S. Ct. at 1739, 82 USPQ2d at 1395. The Supreme Court also has instructed that design incentives and market forces can prompt variations of the prior art, either in the same field of endeavor or in a different field. *Id.* at 1740, 82 USPQ2d at 1396. "If a person of ordinary skill can implement a predictable variation [of the prior art], § 103 likely bars its patentability." *Id.* Similarly, "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id.*

The level of ordinary skill in the art may be evidenced by the prior art references. *In re GPAC Inc.*, 57 F.3d 1573, 1579, 35 USPQ2d 1116, 1121 (Fed. Cir. 1995) ("Although the Board did not make a specific finding on skill level, it did conclude that the level of ordinary skill in the art . . . was best determined by appeal to the references of record . . . . We do not believe that the Board clearly erred in adopting this approach."); *see also In re Oelrich*, 579 F.2d 86, 91, 198 USPQ 210, 214 (CCPA 1978) ("the PTO

usually must evaluate both the scope and content of the prior art and the level of ordinary skill solely on the cold words of the literature").

To facilitate review, the obviousness analysis should be made explicit. *KSR,* 127 S. Ct. at 1741, 82 USPQ2d at 1396 (citing *In re Kahn,* 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness")). However, the Supreme Court made clear that this "analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id.*

In sustaining a multiple reference rejection under 35 U.S.C. § 103(a), the Board may rely on one reference alone without designating it as a new ground of rejection. *In re Bush,* 296 F.2d 491, 496, 131 USPQ 263, 266-67 (CCPA 1961); *In re Boyer,* 363 F.2d 455, 458 n.2, 150 USPQ 441, 444 n.2 (CCPA 1966).

Our reviewing court states that "[d]uring patent examination the pending claims must be interpreted as broadly as their terms reasonably allow." *In re Zletz,* 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989). Our reviewing court further states that "the words of a claim 'are generally given their ordinary and customary meaning.'" *Phillips v. AWH Corp.,* 415 F.3d 1303, 1312, 75 USPQ2d 1321, 1326 (Fed. Cir. 2005) (en banc) (internal citations omitted). The "ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary

skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Id.* at 1313, 75 USPQ2d at 1326.

ANALYSIS

Appellants contend that Examiner erred in rejecting claims 1-11 as being obvious over Hoffman in view of the AAPA and in rejecting claims 12-14 as being anticipated by Scales. Reviewing the findings of facts cited above, we do not agree that the Examiner erred in rejecting claims 1-11 as being obvious over Hoffman. In particular, we find that the Examiner made a prima facie showing of obviousness with respect to claims 1-11. Appellants failed to meet the burden of overcoming that prima facie showing.

We agree with Appellants that the Examiner erred in rejecting claims 12-14 as being anticipated by Scales. However, as will be discussed below, we find that claims 12-14 fail to meet the requirements of 35 U.S.C. § 103 and enter a new ground of rejection pursuant to our authority under 37 C.F.R. § 41.50(b).

Issue 1 (Obviousness):

Appellants argue that Hoffman discloses a transition between interrupt and polling modes when a certain request rate is reached, but "the transition of the present invention is based on the reception of a single interrupt." (Br. 7.) However, under a reasonable interpretation of claim 1, the receipt of a single interrupt is a rate which reads on the teachings of Hoffman. (Finding

of Fact 4.) Therefore, Hoffman teaches this limitation of claim 1 and the similar limitations recited by independent claims 5 and 10.

Next, Appellants argue that Hoffman fails to disclose the speculative scheduling of a further task for processing of subsequently received work items when there are no additional work items for processing, without enabling interrupts. (Reply Br. 2; see also Br. 7.) The Examiner replies that polling is a speculatively scheduling system and Hoffman discloses switching to a polling mode upon receiving an interrupt and scheduling work items speculatively while the interrupt is processed. (Answer 9-10.) We agree with the Examiner.

Hoffman teaches that polling involves successive queries to the peripheral devices regarding their needs for servicing. (Finding of Fact 2.) Under a reasonable interpretation of claim 1, the claim limitation "speculatively scheduling a further task for processing" reads on the polling of Hoffman. Further, Hoffman teaches remaining in polling mode until transitioning back to interrupt mode when certain conditions are met. (Finding of Fact 4.) In other words, while in polling mode, Hoffman disables interrupts until the system transitions to interrupt mode. Therefore, the claim limitation "without enabling system interrupts" recited in claim 1 also reads on Hoffman.

Appellants argue that "the Examiner has made a large leap in equating the polling of Hoffman with the speculative scheduling of the present invention." (Reply Br. 2.) We do not agree, and find no legally significant distinction between the speculative scheduling limitation recited in claim 1 and the polling taught by Hoffman.

Therefore, the obviousness of the claimed subject matter is demonstrated by the teachings of Hoffman considered alone. The interrupt service teachings of the AAPA are merely cumulative to the express as well as the implied teachings already found in Hoffman.

Claims 2-11 were not argued separately with respect to this particular issue, and stand or fall together with claim 1.

Appellants separately argue the patentability of dependent claims 2, 6, and 11. (Br. 7-8; Reply Br. 3.) However, we find that Hoffman also teaches the other limitations of these claims.

In particular, with respect to claim 2, Appellants argue that "[w]hile Hoffman discloses a transition from a polling method to an interrupt method when a certain request rate is reached; the transition of the present invention is based on a previously speculatively scheduled task finding no additional work items received by the system for processing." (Br. 8.)

However, under a reasonable interpretation of claim 2, the receipt of no additional work items defines a threshold for switching from polling mode to interrupt mode. (Finding of Fact 4.) Therefore, Hoffman teaches this limitation of claim 2.

In addition, Appellants argue that "Hoffman fails to disclose the processing of one or more received work items when the speculatively scheduled task is executed, or the speculative scheduling of an additional further task for processing of subsequently received work items after processing the received work items." (Br. 8.) We disagree. The polling mode of Hoffman teaches the processing of a received work item when the speculatively scheduled task is executed and teaches the speculative scheduling of an additional further task for processing subsequently received

13

work items. (Finding of Fact 4.) Therefore, Hoffman teaches these limitations of claim 2 as well.

Claims 6 and 11 were not argued separately with respect to this issue, and stand or fall together with claim 2.

In summary, we find that the obviousness of claims 1-11 is demonstrated by the teachings of Hoffman considered alone.

Issue 2 (Anticipation):

With respect to claims 12-14, Appellants argue that Scales does not disclose using both a polling mechanism and an interrupt mechanism, and does not disclose mechanisms that are dependent on utilization with respect to work items, as recited by claim 12. (Br. 9, Reply Br. 3.)

Reviewing the findings of facts cited above, we agree with Appellants that Scales does not teach each and every limitation of claims 12-14. In particular, Scales teaches a polling mechanism, and also teaches the possible use of an interrupt mechanism. (Findings of Fact 7-8.) However, Scales does not teach or suggest using a polling mechanism or an interrupt mechanism depending upon system utilization with respect to work items, as recited in independent claim 12. Therefore, the subject matter of claim 12 is not anticipated by Scales.

Claims 13-14 were not argued separately, and stand or fall together with claim 12.

REJECTION OF CLAIMS 12-14 UNDER 37 C.F.R. § 41.50(b)

We make the following new ground of rejection using our authority under 37 C.F.R. § 41.50(b).

Claims 12-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoffman.

Regarding claim 12, Hoffman describes effectively providing an interrupt-based mechanism for processing work items when system utilization is low with respect to work items. (Findings of Fact 3-4.) Hoffman also describes effectively providing a polling-based mechanism for processing work items when system utilization is high with respect to work items. (Findings of Fact 3-4.) Therefore, the claimed limitations are rendered obvious over Hoffman's teaching of these two features.

Regarding claim 13, Hoffman describes a device driver associated with a host system (central processor or I/O processor of the workstation) receiving work items the features of claims 12-14. (Finding of Fact 1.) In addition, a person of ordinary skill would know to use a device driver associated with a host system to receive work items. For example, as evidence of the level of ordinary skill in the art, the AAPA teaches that "[w]ith polling, the device driver continually checks the status of the device to determine whether it needs to be serviced." (Specification 1: 23-25.) Therefore, the claimed limitations are rendered obvious over the teachings of Hoffman.

Regarding claim 14, Hoffman teaches that a peripheral may be a disk storage media. (Finding of Fact 1.) A person of skill in the art would recognize a storage controller that services disk storage media as a data processing system to which the teachings of Hoffman apply. (See Finding

of Fact 1.) Therefore, the claimed limitations are rendered obvious over the teachings of Hoffman.

In sum, we conclude that Appellants' claims 12-14 are obvious over Hoffman.

This decision contains a new ground of rejection pursuant to 37 C.F.R. § 41.50(b) (effective September 13, 2004, 69 Fed. Reg. 49960 (August 12, 2004), 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)).

37 C.F.R. § 41.50(b) provides that, "[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review."

37 C.F.R. § 41.50(b) also provides that the Appellants, *WITHIN TWO MONTHS FROM THE DATE OF THE DECISION*, must exercise one of the following two options with respect to the new grounds of rejection to avoid termination of proceedings (37 C.F.R. § 1.197 (b)) as to the rejected claims:

> (1) Reopen prosecution. Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner …

> (2) Request rehearing. Request that the proceeding be reheard under 37 C.F.R. § 41.52 by the Board upon the same record …

CONCLUSION OF LAW

Based on the findings of facts and analysis above, we conclude that:

(1) The Examiner did not err in rejecting claims 1-11 for obviousness under 35 U.S.C. § 103.

(2) The Examiner erred in rejecting claims 12-14 for anticipation under 35 U.S.C. § 102.

(3) Claims 12-14 are unpatentable under 35 U.S.C. § 103 because they are obvious over Hoffman.

DECISION

The rejection of claims 1-11 for obviousness under 35 U.S.C. § 103 is affirmed.

The rejection of claims 12-14 for anticipation under 35 U.S.C. § 102(a) and 35 U.S.C. § 102(e) is reversed.

Claims 12-14 are rejected as being obvious under 35 U.S.C. § 103. A new ground of rejection has been entered under 37 C.F.R. § 41.50(b).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

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AFFIRMED-IN-PART
37 C.F.R. § 41.50(b)

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